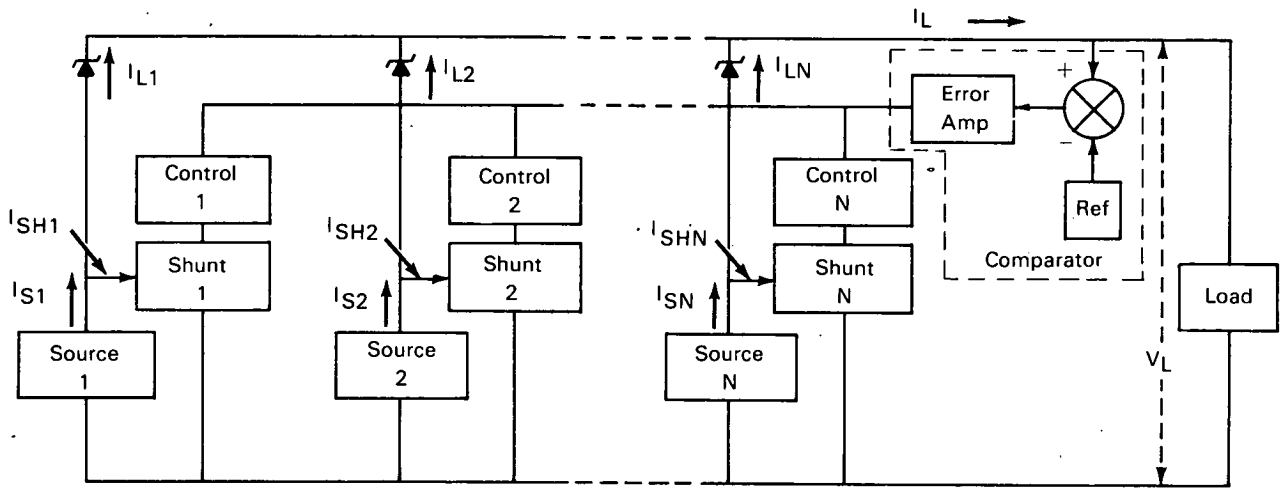
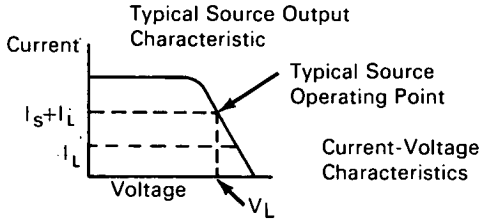
NASA TECH BRIEF

Voltage Regulator with Multiple Parallel Power Source Sections





Typical Operating Conditions for Linear Mode Section Operation

The problem:

To provide an improved voltage-regulating system in which power dissipation and consequent heat generation is minimized.

The solution:

A voltage regulator with multiple power-source sections, each having individually acting dissipative paths that can be controlled sequentially so that only one operates in a linear range at a time. With this device, power dissipation and localized heating will be substantially less than similar effects found in conventional systems.

How it's done:

One embodiment of the innovation is illustrated in the accompanying diagram. A load is connected to a supply line or bus across which is connected a number of parallel power-source sections that are substantially identical. Typically, the output voltage from each section increases as the current drawn from that section decreases. To prevent the output voltage to the load from increasing as the load current demand is reduced, individually acting dissipative paths are provided, each of which is connected to one of the power source sections. These shunts are controlled in response to the output of a comparator that compares the bus voltage with a reference. Thus, as the load current decreases and the bus voltage begins to rise, the comparator will provide an error signal that will actuate one of the shunts to draw additional

(continued overleaf)

current from its associated power-source section, and thereby lower the output voltage. The additional current flows through the actuated shunt path and does not affect the load.

The dissipative paths are preferably comprised of power transistors, which dissipate very small amounts of power in their off and fully saturated states, respectively. Maximum power is dissipated when the transistors are operated in their linear operating range. Appropriate controls, responsive to the comparator error signals, are provided to actuate each of the dissipative paths in sequence as the signal increases or decreases. In this manner, all of the power dissipators except one will be either off or in a saturated state at a given time. Because only one transistor at a time will be operating in its linear state, power dissipation and localized heating will be minimized.

Notes:

1. This invention should be useful for controlling the output voltage of large electrical power sources, such as solar cell arrays.
2. No additional documentation is available. Specific questions, however, may be directed to:
   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B70-10195

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: William G. Binckley and Warren H. Wright of TRW Systems Group under contract to Goddard Space Flight Center (GSC-10891)